

## **REMARKS/ARGUMENTS**

Reconsideration of the application is requested. Claims 21-42 are in the case.

### **I. THE OBVIOUSNESS REJECTION**

Claims 21-42 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent 5,877,348 to Ditzel et al. That rejection is respectfully traversed.

The present invention is directed to a process for producing acetic acid. The process is carried out by carbonylating methanol and/or a reactive derivative thereof with carbon monoxide in a carbonylation reaction zone containing a liquid reaction composition comprising an iridium carbonylation catalyst, methyl iodide co-catalyst, a finite concentration of water, acetic acid, methyl acetate, at least one promoter selected from ruthenium, osmium and rhenium and a stabilizing compound selected from alkali metal iodides, alkaline earth metal iodides, metal complexes capable of generating  $I^-$ , salts capable of generating  $I^-$ , and mixtures of two or more thereof. The molar ratio of promoter to iridium is greater than 2 : 1, and the molar ratio of stabilizing compound to iridium is in the range greater than 0 : 1 to 5 : 1, except that, when the stabilizing compound is a lithium compound, the molar ratio of promoter to iridium is greater than 5 : 1 and the molar ratio of the lithium stabilizing compound to iridium is 0.05 : 1 to 5 : 1. According to the invention, precipitation of the catalyst and/or the promoter from the liquid reaction composition and/or subsequent process streams is reduced.

The Action asserts on page 4 that, at the time of filing of the present application, it was well known to one of ordinary skill that iodide ion had a stabilizing effect on catalysts comprising rhodium and iridium and prevented catalyst precipitation. In

support of his position, the Action cites US 6,211,405 to Cheung. Based on the disclosure at column 3, line 66 to column 4, line 9 of Cheung, the Action concludes that it would have been clearly understood that increasing iodide concentration would prevent precipitation of catalysts comprising rhodium and iridium (Action, page 5).

This position is respectfully traversed. At the outset it is again noted that as of the priority date of the present application, acetic acid was typically manufactured on a commercial scale by one of two processes, namely a rhodium catalyzed process, or an iridium catalyzed process (the iridium catalyzed process is proprietary to the assignee of the present case, BP Chemicals Limited). The rhodium and iridium based processes have different catalytic mechanisms, and teachings in respect of rhodium cannot generally be directly applied to iridium, and *vice-versa*. In a rhodium-based process, the stability of the rhodium catalyst decreases as the amount of water decreases. The carbonylation rate also reduces as the amount of water decreases. Thus, typically, lithium iodide is used in conjunction with rhodium to maintain an acceptable carbonylation rate, i.e, the lithium functions both as a promoter for the rhodium catalyst and also as a stabilizer for the rhodium catalyst. However, to be effective, substantial quantities of lithium iodide are required. The levels of lithium iodide that are required for rhodium promotion/stabilization are known to poison an iridium catalyst. As Ditzel demonstrates in the Table at column 8, the use of lithium iodide with iridium alone is detrimental to the carbonylation rate (column 8, lines 36-39). Thus, in contrast to a rhodium process, lithium does not function as a promoter for an iridium catalyst.

Referring to Cheung, this reference seeks to improve upon the carbonylation **rate** of a **rhodium/iodide**-based catalyst system whilst maintaining the stability of the

catalyst system under low water conditions, i.e., less than 14 wt% water (column 3, lines 5-7). Cheung found that the rate of such a rhodium/iodide system is improved by the addition of iridium (see, column 3, line 66 to column 4, line 2). Table 1 of Cheung shows that iridium added to rhodium/iodide catalyst system significantly raises the carbonylation rate compared to rhodium/iodide alone, and that the addition of iodide to iridium reduces the carbonylation rate compared to iridium alone (column 7, lines 49-56).

Cheung thus discloses that iodide is detrimental to rate for an iridium only catalyst. Cheung discloses that an improved rate for a rhodium/iodide system can be achieved by the addition of iridium. Cheung does not disclose or suggest that iodide stabilizes iridium catalyst *per se*.

The problem sought to be solved by the present invention is different to that addressed by Ditzel. The present invention seeks to solve the problem of iridium/promoter **precipitation** when **high** levels of promoter are present. Cheung is solely focused on improving the rate of rhodium-based catalyst systems, and is not concerned with precipitation problems which occur when high levels of promoter are used in conjunction with iridium.

Furthermore, Cheung leads away from employing iodide in conjunction with iridium in the absence of rhodium. Table 1 (column 8) of Cheung clearly demonstrates that the addition of iodide to iridium is deleterious compared to the use of iridium in the absence of iodide. Thus, the person of ordinary skill would not have been motivated to employ iodide in an iridium-based catalyst system. Cheung therefore is not relevant to

a catalyst system which does not include rhodium and which is solely based on iridium and high levels of a promoter such as ruthenium.

It has been found, according to the present invention, that when high levels of promoter are used in conjunction with iridium, precipitation of the catalyst system occurs. Applicant has addressed this problem by employing iodide in a specified amount, as recited in the claims.

Turning to the obviousness rejection, Ditzel, like Cheung, is concerned with improving rate of reaction. Whereas Cheung wishes to improve the rate of a rhodium catalyst system, Ditzel seeks to improve the rate of an iridium system by using an iodide. Ditzel refers to the iodide as a co-promoter (column 5, line 23). The person of ordinary skill would understand that the term "co-promoter" relates to a substance which aids reaction rate (column 5, lines 23-27). The term 'co-promoter' would not infer or imply to one of ordinary skill that the co-promoter has any influence on stability.

Ditzel discloses that if lithium is used in conjunction with a conventional iridium promoter such as ruthenium, the lithium has a beneficial effect on the rate as the water concentration decreases (column 8, lines 51-61). Ditzel focuses solely on improving reaction rate as the concentration of water is reduced. Ditzel thus suggests that the carbonylation rate in a ruthenium promoted iridium system, at low water concentrations, can be maintained/improved by adding lithium iodide.

Ditzel makes contains no mention or suggestion of preventing or mitigating precipitation of the catalyst/promoter by use of an iodide. Thus, if the person of ordinary skill wished to solve a problem concerned with rate, Ditzel might be instructive.

However, a person of ordinary skill looking to solve a problem associated with precipitation would not be led to any such solution by Ditzel.

Applicant has encountered a problem with precipitation, not rate. As Ditzel is completely silent as regards the use of an iodide to aid precipitation problems, it is clear that there would have been no motivation for one of ordinary skill to resort to Ditzel in regard to solving a problem related to precipitation.

The Action states on page 3 that:

"Ditzel teaches (Column 6 lines 7-26) the establishment of a recycle stream, which contains iridium catalyst and stabilizer, after distillation of acetic acid and, presumably, carbon monoxide and any other non-condensable gases. The stabilizer, as well as other components, is introduced into the reaction by the recycle stream. Ditzel teaches (Column 6, lines 7-26) iodide stabilizer in the range 0.1 1 to 1: 1 with respect to iridium."

In the passage cited by the Examiner (column 6, lines 7-26), and contrary to the statements in the Action, Ditzel does not refer to a stabilizer in the recycle stream, nor does Ditzel refer to the iodide as "iodide stabilizer". In fact, at column 6, lines 7-26, there is no mention whatsoever of the iodide. Moreover, nowhere in Ditzel, is the iodide referred to as a stabilizer. The iodide is only ever referred to as a co-promoter.

The Action also states on page 3 that:

"Further, one of ordinary skill of the art, upon inspection of the graph presented in Fig. 5 would realize that use of higher promoter-iridium ratios leads to higher rates of reaction and therefore higher rates of throughput. One of ordinary skill in the art would therefore have been motivated to use a higher promoter-iridium ratio to achieve a more effective industrial process. There would have been a reasonable expectation for success based upon Ditzel's specific suggestion of this modification of his process."

If the problem to be solved is one of catalyst/promoter precipitation, and Ditzel fails to disclose or suggest any means for addressing precipitation problems, it is not understood why one of ordinary skill would have resorted to Ditzel. The argument espoused in the Action can only be constructed by using hindsight. The solution of catalyst/promoter precipitation is simply non-obvious from Ditzel. Ditzel discloses the use of an iodide to improve carbonylation rate. There is no suggestion in Ditzel that an iodide could be used to improve catalyst system stability.

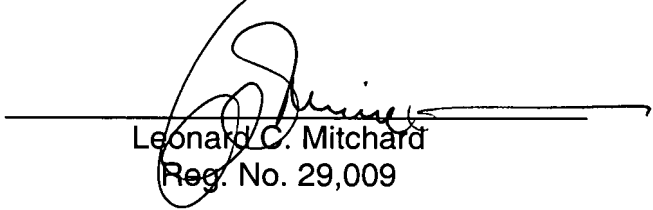
It is clear that no *prima facie* case of obviousness has been generated in this case. Withdrawal of the obviousness rejection is respectfully requested.

Favorable action is awaited.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

By: \_\_\_\_\_

  
Leonard C. Mitchard  
Reg. No. 29,009

LCM:lrm  
901 North Glebe Road, 11th Floor  
Arlington, VA 22203-1808  
Telephone: (703) 816-4000  
Facsimile: (703) 816-4100